UNIT I

Number Systems & Boolean Algebra

Signed numbers 1's and 2's complement codes

Signed Binary Number

The number without positive signs are known as unsigned numbers.

It always considered as positive number.

- Positive(+) sign is used before the number to define positive number.
- negative(-) sign is used before the number to define negative number.

In case of signed binary number system. The most significant bit represents the sign of the number .

When the MSB is 1, the number is negative and when it is 0, the number is positive.

There are three methods used sign binary numbers.

- Sign magnitude representation
- 1’s complement representation
- 2’s complement representation

Sign magnitude representation

- In sign representation of a binary number, the MSB represents the sign and the remaining bits represents its magnitude. When MSB is 1, the sign is negative and if it is 0, the sign is positive.
- Consider the binary number : $(B7B6B5B4B3B2B1B0)_2$
- Where b7 represents the sign and b6 to b0
- Example :

  00001000 +8

  10001000 -8

  01111111 +127

  11111111 -127

- In generalized form, the n-bit binary number in 1's complement form represents the maximum positive number as (2^n-1),

1’s complement

- The 1’s complement of a binary number is obtained when each bit of a binary number is subtracted from 1.
- The 1’s complement of 0 is 1-0 =1 and the b1’s complement of 1 is 1-1=0
- MBS is o for positive and 1 for negative binary number.
- Example :

  00001000 representation +8

  the 1’s complement of +8 is 11110111
- The 1’s complement of a positive binary number is negative and vice – versa.
- (+8) is represented by (00001000) where as 11110111 represent (-8) In 1’s complement representation of binary number.
- In generalized form, the n-bit binary number in 1’s complement form represents the maximum positive number as (2^n-1),

Steps

1. Write the positive number in binary form.
2. Find the 1’s complement of the binary number.

2’s complement

- The 2’s complement of a binary number is obtained by adding to the 1’s complement of a binary number.
- The most significant bit is 0 for positive number and 1 for negative number.
- Example :

  1’s complement of (+8) = 11110111

  2’s complement of (+8) = 11110111

  \+ 1

  11111000

- The 2’s complement of a positive number is negative and vice- versa.
- Unsigned 8 bit binary number represents the maximum decimal number as 255;
- 2’s complement eight bit binary number represents the maximum positive number as 127 and maximum negative number as -128.
- The n bit unsigned binary number represents the maximum positive number as (2^n-1), and n bit binary number in 2’s complement form represents maximum positive number as $(2^{n-1}-1)$, and the maximum negative number as (2^{n-1}).

Steps

1. Write the positive sign number
2. Find the 1’s complement of the number by replacing 0 by 1 and 1 by 0.
3. Find the 2’s complement of the number by adding 1 to 1’s complement of the number.

1. Find the sign –magnitude representation of number using 8 bits

a)+27

b) -27

c)+101

d) –106

2. Find decimal equivalents of the following numbers

a) $(10100001)_2$

b) $(00010011)_2$

c) $(10110011)_2$

3. Represent the following decimal number in 1's complement representation using eight bits.

a) -67

b) 102

c) -88

4. find decimal equivalent of the following binary numbers

a) $(10100111)_2$

b) $(01010011)_2$

c) $(10111011)_2$

Thank You